



Harsh

Environment

Cable Solutions

Crosslinking Cure Systems Comparison

Olefin based compounds are continuing to gain more favor in the wire and cable industry as both insulation and jacketing materials. The crosslinked counterparts of these materials are also experiencing increased usage due to higher temperature capabilities resulting from vulcanization of the material. Recently, questions regarding the quality of peroxide crosslinked products relative to that of irradiated systems have been raised.

Crosslinking is a process of tying together individual polymer chains in a compound into a three dimensional matrix. This crosslinking, or vulcanization, generally takes place as a result of an energy source added to a material, which in turn activates a crosslinking agent. This crosslinking agent then reacts with the polymer, forming a network of covalently bonded polymer chains. The effect of crosslinking can be seen in improved dynamic, physical, and chemical properties on the compound.

In the case of peroxide cured polyolefins, a peroxide based crosslinking agent is used. These peroxide crosslinking agents decompose in the presence of heat, activating vulcanization sites and initiating the reaction.

In the case of irradiated cure systems, the vulcanizing agent is often a chemical that decomposes when exposed to a radiation source. This type of process commonly is carried out at room temperature and pressure, and utilizes radiation as the energy source. The radiation activates the polymer, initiating the vulcanization reaction. Once the reaction is initiated, the chemical process is identical to that seen in the peroxide cure systems discussed above.

In comparing the two vulcanizing systems, the only difference in the crosslinking process is the energy used to activate the system, and the chemical crosslinking agent employed. The crosslinked polyolefin itself is the same in either case.

Much has been stated regarding the improved properties of irradiated systems relative to peroxide cured systems. As discussed, chemically there is little difference between the actual network formed during the vulcanization process.

The major disadvantages of the irradiated systems are the need to use higher molecular weight polymers to prevent distortion of the product after extrusion and before irradiation, and the inability to completely vulcanize thick cross sections. The need to use higher molecular weight polymers directly impacts the flexibility of the resultant wire, resulting in a measurably Astiffer@ product. The limitations on cross sectional area limit the insulation wall thickness, and correspondingly the voltage ratings, of these products.

Peroxide crosslinked systems generally use the lower molecular weight polymers to minimize heat build up during processing. The use of peroxide vulcanizing agents eliminates the cross sectional area limitations seen in the irradiated products. Additionally, the use of lower molecular weight polymers imparts a much more flexible feel to the resultant wire.

Peroxide cured cables have been successfully used in multiple applications in wire and cable for several years. The only major difference between the peroxide and irradiated cure systems is in the type of energy used to drive the vulcanization reaction and the crosslinking agent employed. The result of the crosslinking reaction is identical in both types of cure systems, leading to the conclusion that performance of cables vulcanized with either of these system are equivalent.



**The Global
Cable Solutions
Company**

10633 W. Little York, Bldg. 1 • Suite 100 • Houston, Texas 77041
Fax (713) 849-9009 • (713) 896-5800 • (800) 506-9473 • e-mail: marine@amercable.com • www.amercable.com